NEED TO KNOW
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Flight School

INL evaluates lightweight, affordable UAVs for security operations

INL security officer Bob Adolfson stands in front of an unmanned aerial vehicle equipped with small, sophisticated digital video technology.

A thousand feet above the desert landscape of Idaho National Laboratory, a faint, high-pitched humming – like the sound from a distant motorcycle – is heard overhead as a single, brightly painted unmanned aerial vehicle darts across a dark skyline quickly snapping hundreds of digital images and capturing real-time video feeds from the ground below.

Today's mission – like a chapter out of a spy novel – is the first of several dozen INL flights planned over the next year to evaluate whether low-cost, field-deployable unmanned aerial vehicles equipped with digital video cameras could assist daily security operations across the laboratory's 890-square-mile terrain.

Cross Training

In a joint effort between the INL UAV program and the Safeguards and Security Department – which oversees site security – INL UAV and robotics engineers are cross training security guards on the unique skill sets needed to fly and operate several 10-foot unmanned aerial vehicles equipped with advanced technologies developed by INL and commercial partners.

The project utilizes the INL Critical Infrastructure Test Range and several related UAV facilities such as the laboratory's 1000-foot runway, command station and catapult launching system as a proving ground for transitioning a portion of the existing UAV research and development program into routine security operations. But the project goes beyond the traditional R&D role that a national laboratory plays by incorporating the research and design of small UAVs with an element of testing and evaluation for multiple end users.

"Since 9/11 federal facilities have been at a higher state of alert," said UAV engineer Matt Anderson. "We developed this project as a way to provide the next level of security for Department of Energy complexes nationwide."

Last year, in preparation for the project, INL purchased four UAV airframes, a launching system and several camera units to begin flight training INL security guards.

Lieutenant Bob Adolfson, a 19-year veteran of the INL's security force, was recommended to be the first security guard to undergo flight school due in part to his experience as a radio-controlled pilot.

"My dad always flew remote-control planes, so as a kid I was flying too," said Adolfson. "It has been helpful to have that background because UAVs have

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INL Idaho National Laboratory

State of the Directorate

Dr. KP Ananth,
Associate Laboratory Director, National and Homeland Security

The beginning of our second calendar year as Idaho National Laboratory is upon us. As we look toward the future, I wanted to take a moment to thank our employees for your hard work and dedication that resulted in a very successful first year. I'd like to ask that we continue to stay focused on the missions at hand.

Last year, the National and Homeland Security Directorate exceeded our financial business goals and increased our overall business volume by more than 50 percent over last year! This is a tremendous accomplishment and a true reflection of our staff and support personnel. Equally important, we have had national recognition on several of our key programs and several of our employees were honored with national awards and patents in 2005, including an R&D 100 award.

Your accomplishments are significant achievements for the laboratory. But even as we celebrate, we must remain focused on achieving our overall objective of transforming INL into a leading center for National and Homeland Security technologies, particularly in the areas of Critical Infrastructure Protection and Nuclear Nonproliferation.

As outlined in the laboratory's Strategic Plan, the National and Homeland Security Directorate has committed to succeed in four major initiatives by 2015. They are:

- Establish a Center of Excellence in Critical Infrastructure Protection
- Establish a Center of Excellence in Nonproliferation
- Establish a Center of Excellence in Electric Grid Reliability
- Grow annual budget to $205M

In the last year, I have had numerous opportunities to meet with key customers, our congressional delegation and other national leaders. Many have provided positive feedback and continue to see value in our work, core capabilities and efforts to secure the nation and protect our citizens.

As we enter a new year, it is important to realize that it will take the continued hard work of all of us - committed to simultaneous excellence - to meet our customer expectations, deliver products and solutions and create a safe and secure working environment. If last year is any indication of the performance, commitment and dedication of our staff I am confident we will be successful.

UAVs *(continued from page 1)*

similar aerodynamic characteristics and preflight protocols as radio-control planes."

But before Adolfson flew his first practice mission, he had to get comfortable with the plane's command and control characteristics such as the roll, pitch and yaw, or side-to-side, front-to-back, and vertical rotation of the airframe while in flight.

Last summer, Adolfson was assigned nearly full-time to the UAV program, spending countless hours on the runway watching, learning and test flying the small planes. He also spent time in INL's engineering labs learning how the mechanical components, sensors, and camera system functioned together to provide constant communication between plane and controller, real-time video footage, and instant command and control options.

Test Flights

Last September, several UAV vendors and security personnel from INL and DOE headquarters came to the laboratory to witness first hand the security advantages offered by the use of lightweight, man-portable UAVs capable of performing real-time mission planning, configuration and digital image processing.

As part of the demonstration, a UAV with a preprogrammed flight path was sent airborne to collect video feeds directly above the runway facility. At the same time, nearly five miles away, Adolfson and UAV engineer Warren Jones transferred control of the plane via a mobile UAV ground station, and changed the flight path to collect footage over a different area of interest.

During the two-hour demonstration, the UAV provided constant, real-time video footage from the air utilizing a commercially available NTSC video camera and RF transmitter. Mounted on the underside of the plane, the camera provides clear and stable high-resolution imagery by compensating for engine and flight vibrations. The real-time video footage is transmitted wirelessly to the ground station where it is digitized, time stamped and aligned to the GPS coordinates of the UAV.

As video footage comes in from the plane's camera systems, it is laid out in a mosaic pattern that illustrates the movement of the plane over the flight path and provides situational awareness. Software built into the ground station computers instantly select the best images coming in from the plane at 30 frames per second and displays them on several wide-screen monitors where it is evaluated for threats by security personnel.

Each plane comes equipped with specialized avionic technology, allowing the planes to accurately capture real-time video and still images at average speeds of 60 mph and within a line-of-sight radius from a ground control station or remote terminal. Camera systems can also include features for nighttime operations and zoom lens for detailed surveillance operations.

According to Anderson, the demonstration showed the ability of the plane and camera to adapt to a changing environment, something that would be crucial during an actual emergency.

"Five years ago you couldn't buy cameras of this quality and size without spending hundreds of thousands of dollars," said Anderson. "Today the advantage of such small, compact design elements allows missions to be tailored for specific and evolving security operations."

In order to comply with Federal Aviation Administration guide-

lines, line of sight was constantly maintained on the plane during the demonstration.

UAVs in Use

Deploying UAVs with cameras and sensors for security and surveillance applications is not a new concept. Military, homeland security and intelligence organizations routinely use large, multi-million dollar UAVs such as the Global Hawk or Predator drone to relay crucial reconnaissance information to soldiers and border patrol agents. Recently, the Department of Defense reported that more than 1000 UAVs are being used in the airspaces over Iraq and Afghanistan.

But large UAVs – some with wingspans approaching 100 feet long – can cost several million dollars each, and often rely on a team of technical experts to fly them.

In contrast, the point of the INL project is to demonstrate the accuracy and reliability of significantly smaller and affordable UAVs to achieve the same results.

"You usually can't touch a basic, small UAV package (airframe, ground station and sensor systems) for under a hundred thousand dollars," said UAV program manager Scott Bauer. "We're attempting to keep the technology affordable so that the transition from military to private security operations will be reasonable for the user."

According to Bauer, the INL UAVs and camera systems can achieve quality, real-time video feeds at a cost of $25,000 or less.

In the Future

Only a few months into testing, the security training program has garnered attention from organizations that are facing new security challenges in the post- 9/11 world.

"We've had security experts from companies that are now challenged to protect thousands of miles of open landscape or infrastructures like powerlines," said Adolfson. "Right now, many of them are using manned helicopters that are expensive to fly and maintain, and are less safe then an unmanned vehicle."

Currently, Adolfson is the only guard to have undergone the comprehensive training program. However, plans for 2006 call for additional guards to undergo both classroom and flight training. Eventually, INL hopes to have a trained UAV guard on call for every shift.

"This project really marks the first time that a DOE national laboratory has attempted to transition a UAV research program into an operational resource," said Bauer. "Small UAVs are a new tool for security operations and a strong need exists for them to be mission tested and value determined by security personnel. That's what we're attempting to do."

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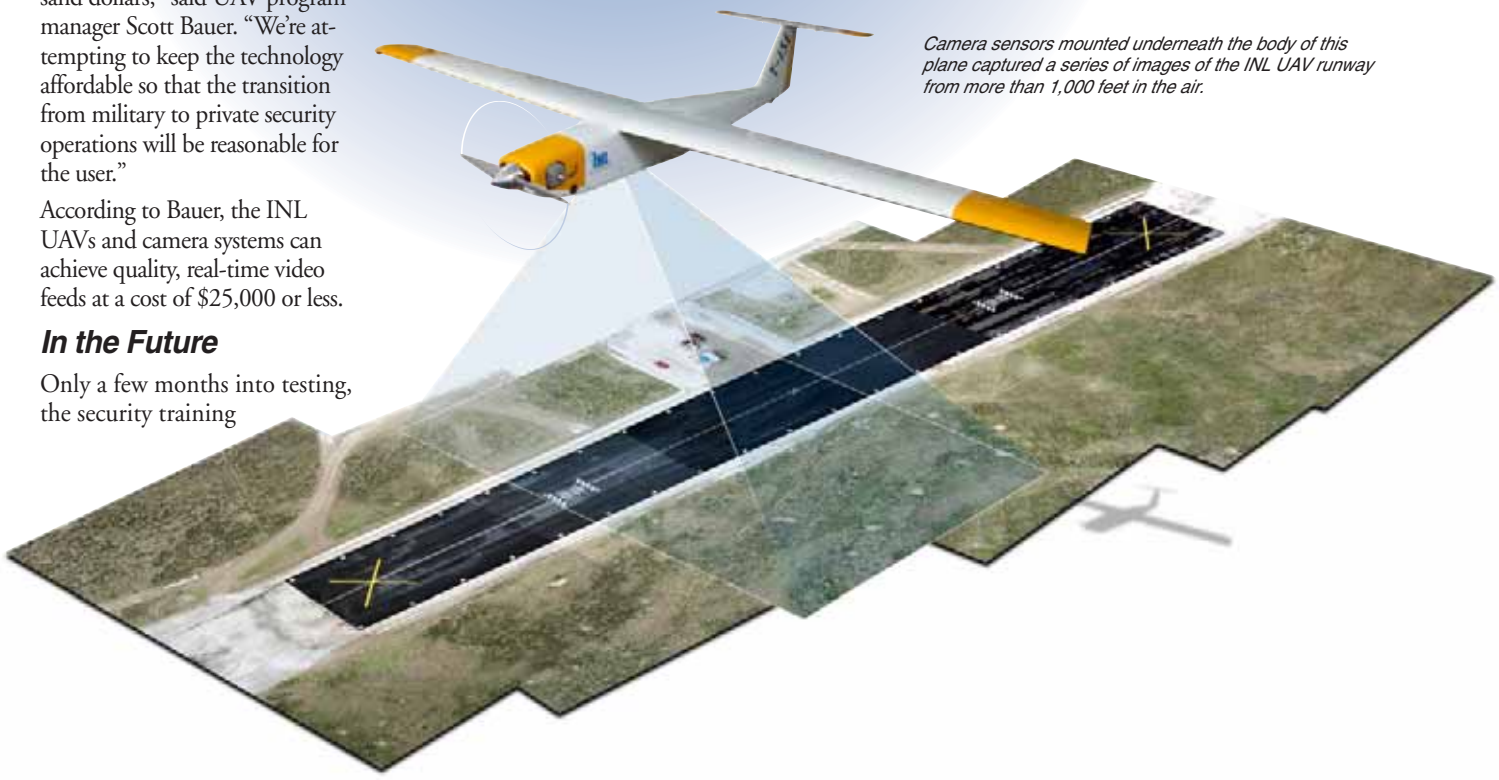
INL UAV and robotics engineers prepare a plane for launch during a demonstration last September. These small unmanned aerial vehicles can be operated from a mobile ground station using wireless technology. (above).

An INL UAV is launched from a trailer-mounted catapult system. This technique is useful during security operations when a runway may not be available. (right).



Camera sensors mounted underneath the body of this plane captured a series of images of the INL UAV runway from more than 1,000 feet in the air.

INL CBRNE program managers Don Verrill (left) and Stacey Barker (right) explain the equipment packaging procedure to Lieutenant Colonel Patrick Terrell.

Gearing Up

INL supports Army's CBRNE teams with equipment / training

In 1997, John Salcedo – a 23-year-old private first class Army soldier – stationed at Johnston Island Chemical Storage facility in the middle of the Pacific Ocean came across a frightening discovery. While performing a routine search through several hundred World War II containment drums filled with old, chemically contaminated military uniforms, Salcedo opened a coat pocket only to find himself staring directly at a small vial of mustard agent.

As a veteran of the U.S. Army's 22nd Chemical Battalion (22D CHEM BN), Salcedo was trained to handle and dispose of chemical weapon stockpiles, but the surprising discovery was quite a shock.

"That moment was a rush, the vial was clearly in the wrong spot," remembers Salcedo. "It was only because of my training and equipment that I knew exactly what was in the vial and how to handle the situation."

For military personnel with training similar to Salcedo, handling and containing dangerous chemicals and explosives is not an uncommon task. Fortunately, these special teams have access to the most advanced equipment and tools necessary to do their jobs safely and efficiently. Building on a strong relationship Idaho National Laboratory was recently asked to assist the U.S. Army in gearing up the soldiers of the 22nd Chemical Battalion, a branch of the Army's 20th Support Command.

How it Works

Following the terrorist attacks of 9/11, the Army anticipated a need for additional soldiers trained to respond to chemical and biological incidents. The number of nations and non-national terrorist and criminal organizations capable of developing, possessing and deploying chemical, biological, radiological, nuclear and high-yield explosive (CBRNE) weapons is steadily increasing.

In order to concentrate on the development of plans, procedures, complex training programs and the buildup of trained soldiers, the 22nd Chemical Battalion needed assistance with the concurrent buildup of specialty equipment. That's where the INL came in.

Known as the CBRNE Systems Integration Project, INL staff members work directly with the soldiers and commanders of the Army's 22nd Chemical Battalion to ensure that the technology and equipment they need to handle any situation is available and ready for use. During CBRNE operations, responding teams never know what they might encounter, so a wide range of equipment is required.

To be able to perform their mission of identification, verification and render-safe, the soldiers need ruggedized, sophisticated equipment. According to Salcedo, it's not uncommon for teams to enter buildings and find a suspicious package concealed or strategically located in an immobile position.

"When we're deployed it's because of a worst-case scenario," said Salcedo. "If there is a concrete wall in the way of disposing a radiation hazard, we need equipment that can cut the wall down or we could risk disturbing a volatile substance and endangering lives."

To ensure that the CBRNE program runs efficiently, INL established a special procurement protocol with the Army allowing the necessary equipment to be ordered quickly and shipped to Idaho from a variety of locations and vendors across the United States and the world. The protocol was required to meet special provisions for military-use-only equipment.

Once in Idaho, the equipment is taken to an INL fabrication facility where staff collects information such as serial numbers,

part numbers and warranty information. Each piece is then measured for proper size, dimensions and shape, so that custom foam packaging and ruggedized cases can be fitted to secure the items in transit. Most equipment also has to be powder-coated with black paint to conceal any bright colors or shiny labels that might later become a target for snipers or insurgents.

Once each plastic roto-molded case is sealed and labeled, it is loaded into large aluminum containers, about the size of a commercial refrigerator. The aluminum containers are then placed inside a military Internal Airlift/Helicopter Slingable Container Unit better known as an ISU-90. Each ISU-90 is transported by flatbed truck to designated staging locations and eventually airlifted with responding teams to incidents or training missions. Each equipment set has enough supplies for one CBRNE team.

Equipment for the Army's 22nd Chemical Battalion, such as concrete saws and shop lights, arrive in Idaho from multiple vendors where they are tested, ruggedized, packaged and shipped to soldiers.

According to Lt. Col. Patrick Terrell – who oversees the Army's CBRNE operations – the work being done with INL saves the Army the time and logistics associated with handling massive equipment inventories and maintenance duties.

"This program allows us to focus on our primary task of training and responding, as opposed to spending hundreds of hours dealing with individual vendors," said Terrell. "This process has become an effective way for us to match the buildup of human forces with material resources."

A Long History

For more than a decade, the Army has relied on the expertise, training and services offered by engineers and researchers at INL. Between 1992 and 1995, laboratory engineers assisted the Army with the safe disposal of old munitions using INL's award-winning Portable Isotropic Neutron Spectroscopy system, and by developing Mobile Munitions Assessment System vehicles that have been used to recover old, unexploded ordinance from Maryland to California. In 2003, during the initial stages of operations within Afghanistan and Iraq, INL provided equipment support to Army personnel engaged in combat.

Today, a team of 12 INL specialists is working to supply each CBRNE team with a mix of equipment ranging from technologies developed at INL – such as the Hazmat Cam and PINS system – to more common items such as wireless radios, door-breaching systems and gas chromatographs. In 2004, the Army awarded INL an $8 million contract.

Army Lieutenant Colonel Patrick Terrell holds an INL-developed Hazmat Cam. This award-winning technology is one of more than 500 items that is routinely packaged and shipped to CBRNE teams.

The majority of the funding pays off-the-shelf costs for the equipment. The INL staff uses the remaining funding to test, package, ship and maintain the equipment at a state-of-the-art level. A major advantage INL offers the Army is its diverse range of real life testing environments and a competent workforce.

"We have 3500 employees with backgrounds from nuclear technology to weapon systems," said INL project manager Don Verrill. "In the past, we've gone to our scientists and security forces at the Site and used their facilities and expertise to test this equipment under a real-world environment, before it's needed on an actual mission."

According to Verrill, the testing and evaluation offered at INL ensures that all the equipment is functionally operational and ready to perform under the most demanding conditions.

The INL team is frequently called upon to provide immediate support to missions. During November 2004, the INL team provided equipment support to an already deployed unit near the U.S. - Canadian border, and also assisted in preparing equipment in support of the presidential inauguration in January 2005.

Future Plans

Recently Lt. Col. Terrell visited INL to get an update on the program. Following a tour of the facilities and meeting with key employees, he emphasized the importance of the program.

"When you're deployed in Iraq, there isn't a RadioShack around the corner to get lightbulbs or batteries for your flashlights," said Terrell. "The equipment has to work right the first time and everytime."

According to Terrell, INL is meeting that challenge.

Last September, the INL team wrapped up production on four sets of equipment and sent them to the Army for CBRNE training operations and deployment. The staff recently received an additional request and funding from the Army to support the buildup of eight more sets of equipment.

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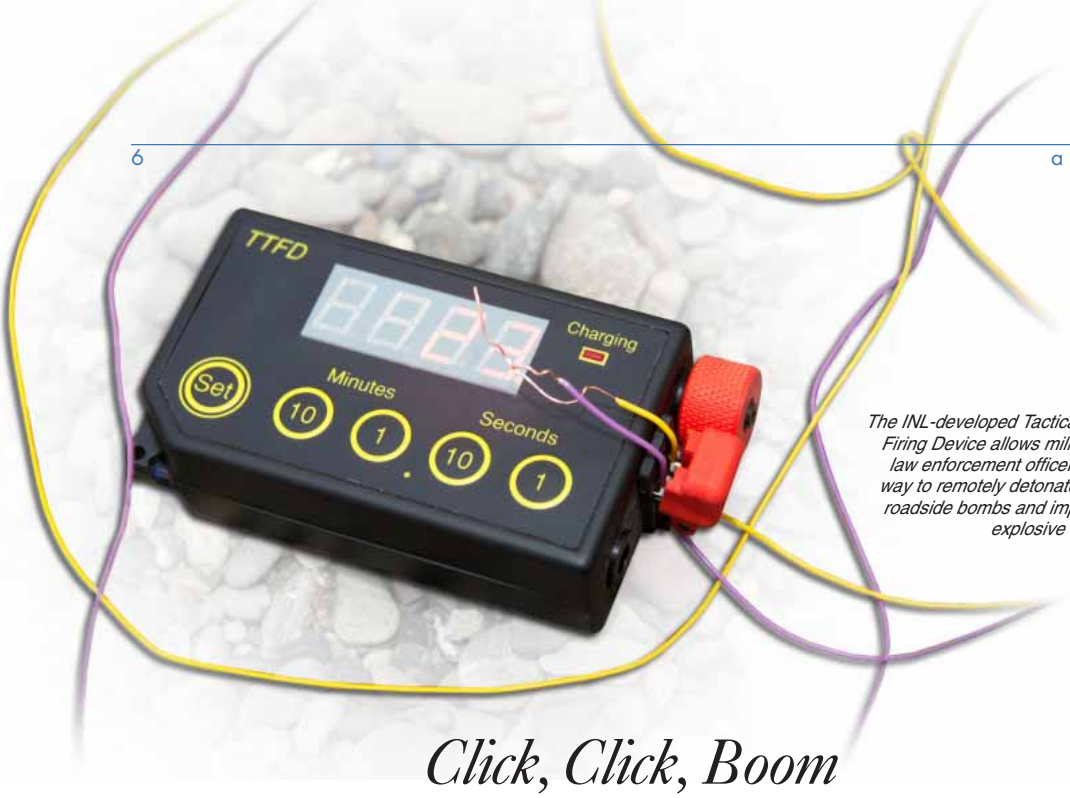

The INL-developed Tactical Timed Firing Device allows military and law enforcement officers a safe way to remotely detonate mines, roadside bombs and improvised explosive devices.

Click, Click, Boom

INL demonstrates the Tactical Timed Firing Device

From Die Hard to James Bond, blockbuster movies routinely use spectacular effects and explosions to entertain audiences. Often, large movie explosions are triggered by a bright, red-lit, digital clock rapidly counting down to zero and setting off a massive charge. In reality – and to the surprise of most – low-cost, disposable explosive timing devices haven't previously been available to military or law enforcement personnel. At least not until now.

Recently, researchers at Idaho National Laboratory demonstrated to military, law enforcement and commercial partners the Tactical Timed Firing Device. This small, self-contained timing unit – about the size of a standard military M4 carbine rifle magazine – is capable of initiating an explosion after a preset time ranging from seconds to an hour.

During an appropriate tactical situation, the design allows the disposable timer to be directly connected via shock tube or wire to a small amount of explosive agent, such as C4, and set to automatically detonate without anyone needing to be physically present to push a button.

"Dealing with explosives is dangerous work," said designer Steve Frickey. "We've tried to make their work safer by reducing the time and exposure spent around dangerous materials."

The device was commissioned to provide military and law enforcement officers with a low-cost, safe option when they are challenged to remove or destroy improvised explosive devices, mines or roadside bombs. And the threat is real. In 2003, experts estimated that more than 10 million mines were currently buried in Iraq.

For the last year, Charlie Johnson, an officer with the Houston, Texas bomb squad has been intricately involved in the progress of the INL's Tactical Timed Firing Device and believes it has uses beyond just the military community.

"Given the threats we face today, we are seeing a blending of tactics and technologies between police and military," said Johnson. "Police departments are moving toward a military style and military are incorporating police tactics."

Designing the Device

The concept for the device began in 2004 after the Department of Defense made a request in its annual Broad Area Announcement which details all of the technologies needed to support various military missions.

After being approached by his manager to pursue the project, Frickey spent several weekends and evenings at home in his own shop fabricating and tinkering with ideas that he thought would make the device successful.

"In the early days, I spent a lot of my own time playing with ideas that I thought might make this come together," said Frickey. "I changed pins on circuit boards, reprogrammed the microprocessor and refined the source code before the fundamental concepts came into place."

Once an initial design was built, engineer John Svoboda was enlisted to help refine the circuit and reconfigure the layout of the circuit board allowing it to function as a smaller and lighter

Tactical Timed Firing Device designer Steve Frickey connects shock tubing to his device during a demonstration last November.

package. The refined circuit board automatically detects whether shock tube or wire is connected to the unit.

In November 2004, the Technical Support Working Group (TSWG), the federal government's national forum for identifying and coordinating research and development requirements for combating terrorism, accepted Frickey's proposal and provided funding for its development.

At the first meeting between INL and TSWG in January, Frickey demonstrated a mock up his design. The rough proof-of-concept consisted of LEDs, switches, a microprocessor and a circuit board connected by a string of wires that fired photo flashbulbs when the timer hit zero.

"Having something to show us that early really proved there was a sense of direction and commitment to the project," said Mark Asselin, program manager from TSWG. "That was the best kick-off meeting that I've ever been to."

Operating the Device

Using an elongated key to turn the device on, each unit builds power through a complex system of electrical components. Once the desired countdown time is set, a microprocessor inside rapidly oscillates on and off at a set frequency and tempo. This action forces small bursts of power into a capacitor, which acts as a holding tank for the energy. Once the capacitor reaches sufficient energy it is capable of discharging a spark that charges the attached shock tube or wire causing a detonation.

The Tactical Timed Firing Device weighs in at just 6.2 ounces and can reach peak voltage in as little as 15 seconds, or be delayed up to 59 minutes and 59 seconds. Each unit has dual outputs allowing it to handle and recognize three different sizes of shock tube, or a single blasting cap. A built-in shock tube cutter eliminates the need to carry extra tools, while nylon screws and a tough microprocessor allow it to resist electrical or static shocks.

Air Force explosives ordnance specialist Richard Mills sets the countdown time on an INL-developed Tactical Timed Firing Device.

During development, prototypes were tested against harsh weather elements in an environmental chamber which replicated temperature ranges between zero degrees and 135 degrees Fahrenheit. Even under extreme heat, cold and humidity the Tactical Timed Firing Device delivered a calculated spark at several different time sequences.

Before its advent, a typical controlled explosion required a small amount of C4 or other plastic explosive to be placed near the suspected item. Then, several yards of either shock tube or electrical wire had to be attached to the C4 via a blasting cap and strung out to a safe distance away from the blast.

With the Tactical Timed Firing Device, the need to string yards of shock tube or wire is eliminated because the device was developed to be destroyed with the suspect item and therefore only requires a few inches of detonation cord and a small explosive agent to detonate the suspect material. The device can also be used for breaching purposes or as a diversionary tactic.

Referring to the threat posed by improvised explosives devices, Richard Mills, an Air Force explosives ordnance disposal technician and demonstration participant remarked, "Unfortunately, all the stuff you see in Iraq is eventually going to make its way to the United States."

"Preparation now is going to be the key to defeating these threats," said Mills.

During a demonstration at the INL's Live Fire Test Range, the Tactical Timed Firing Device remotely detonated several simulated improvised explosive devices.

What's Next

Following a federal business opportunity announcement last November, the Tactical Timed Firing Device was licensed for production by Boise, Idaho-based proswat, incorporated. Proswat licensed the INL-developed breaching shotgun earlier last year.

It is expected that the device will undergo some cosmetic changes including the development of a more durable, water-resistant ABS plastic housing before being commercially available.

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Phishing: Don't get caught hook, line and sinker!

Contributed by Jodi Hansen

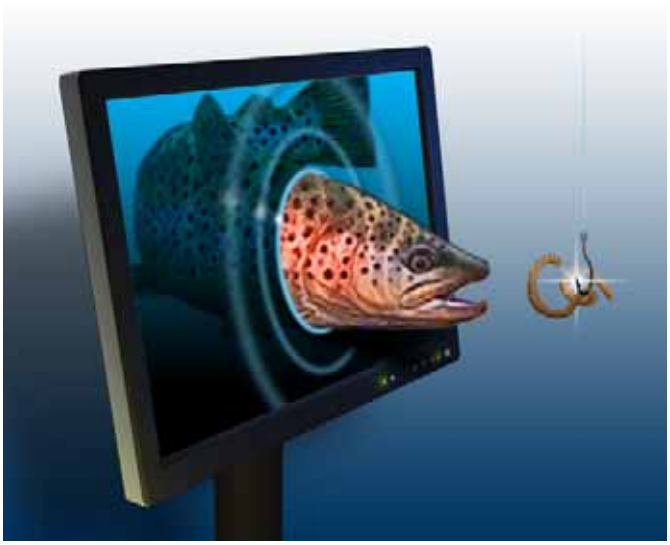
A recent survey by Integrated Payment Systems, a leading payment solutions provider, reported that as many as 43 percent of online users have been targeted by a "phishing" (pronounced fish´ing) scam and five percent of users have given up personal information.

Phishing is a deceptive scam, which tricks consumers into disclosing highly confidential — and valuable — information such as credit card numbers, bank account pin numbers or Social Security numbers which can later be used for identify theft. This normally happens when a fraudulent e-mail is received appearing to be from a major business, financial institution or government agency.

These emails entice recipients to click on hyperlinks that direct users to counterfeit sites that appear to look real. Phishers typically include false statements such as messages marked urgent, or account closed in their emails to get people to react immediately. Once recipients are on the spoofed site, disclaimers instruct recipients to supply personal information such as account numbers.

Phishing is increasingly becoming more sophisticated and common. Experts estimated in 2003, that phishing cost consumers about 1.2 billion a year. Due to the exploding trend of phishing attacks, many businesses and the Internet industry are taking the threat seriously.

Legitimate businesses rarely solicit personal information from their consumers via email. If you receive an unsolicited email requesting account information or other personal data, do not reply to the message, and instead immediately contact the company involved in the fraud directly.



Phishing is a deceptive scam, which tricks consumers into disclosing highly confidential information such as credit card numbers, bank account pin numbers or Social Security numbers which can later be used for identify theft.

You can also report the fraud to the Internet Fraud Complaint Center, which is a partnership between the FBI and the National White Collar Crime Center. If you feel you have been the victim of a phishing scam, contact your financial institution and credit card companies as soon as possible.

Tips for Avoiding Phishing Scams

- Be suspicious of any email requesting personal financial information and avoid filling out any forms that request this information
- If you suspect the message might not be authentic, don't use the links in the email to get to the web page
- Ensure that your browser and security patches are applied
- Always ensure that you're using a secure website when submitting credit card or other sensitive information via your Web browser
- Regularly log into your online accounts and review your bank, credit and debit card statements to ensure that all transactions are legitimate
- To make sure you are on a secure Web server, check the beginning of the Web address in your browser's address bar - it should be "https://" rather than just http://. (The "s" stands for "secure")
- Check www.antiphishing.org to see if the email you received is listed as a scam

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